



The rise and fall of e-cigarette cloud chasing appealing to youth

Emma Brett, Robert Krissinger, Andrea King*

University of Chicago, Department of Psychiatry & Behavioral Neuroscience, United States

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ABSTRACT

Electronic cigarette (e-cigarette) use continues to rise among youth with new devices and technology outpacing regulation. The “cloud chasing” phenomenon, whereby vapers compete or otherwise showcase the production of large or artistic exhaled aerosols from e-cigarettes, played a role in the early appeal of e-cigarette use in youth. This paper describes the sudden rise in the phenomenon of cloud chasing on social media and at vaping conventions due to the proliferation of second and third-generation powerful e-cigarette devices in their peak in 2015 and then their subsequent decline in the past few years. We describe four distinct factors that affected both the rise and fall in cloud chasing, including: 1) the rapid evolution of powerful e-cigarette devices, 2) the increase in social media promotions, 3) an inability of regulatory bodies to keep up with evolving ENDS technology, and 4) two recent widespread health concerns and conditions. Conclusions highlight the importance of swift regulation and effective health communication to mitigate unintended consequences of product evolution. It remains unknown whether such vape tricks and related competitions will reemerge and appeal to youth as store fronts reopen and devices continue to evolve.

1. Introduction

The use of electronic nicotine delivery systems (ENDS), or electronic cigarettes (e-cigarettes), has proliferated globally since entering the market in the early 2010s (Dai and Leventhal, 2019). In the United States (U.S.), ENDS use has reached epidemic proportions among youth with nearly one in five high school students reporting current e-cigarette and more than one-third using nearly daily (Wang et al., 2020). There are several factors that led to the increased prevalence of vaping in youth, including product availability, e-liquid flavorings and high nicotine content, and the deluge of social media posts that created a culture of vaping as recreation and a perceived safer alternative to combustible smoking (Leavens et al., 2019; Tsai et al., 2018; Huang et al., 2016; Pepper et al., 2017).

Perhaps the most extreme depiction of vaping behaviors is the phenomenon of vape tricks, also known as “cloud chasing.” These involve the exhalation of e-cigarette aerosols to produce a large or artistic vape cloud from the users’ mouth or nose. Within several years of the advent of ENDS sales in 2011, cloud chasing competitions emerged in vape shops. By late 2015, vape tricks pervaded the vaping zeitgeist and arguably reached their apex, with visual examples often displayed in public service announcements (see Fig. 1). However, from 2016 to 2018,

cloud chasing competitions waned and related social media platforms garnered only a fraction of the attention they received in prior years (Fig. 2). Cloud chasing may have been an ephemeral trend common in youth or the result of a confluence of factors that propelled its popularity and then led to its decline. This commentary will describe these possible factors and address the issue of whether cloud chasing will continue at its nadir or undergo a resurgence in a post-COVID-19 world.

The first factor that led to the rise of cloud chasing was the rapid evolution of vape products. When devices were first marketed in 2011, they were closed-system products that resembled traditional cigarettes, i.e., “cigalikes,” producing unobtrusive exhaled aerosols. But that landscape changed considerably by 2013 with the advent of second and third generation open-system ENDS, also known as “advanced personalized vaporizers” or “box mods.” These devices allowed modifications (ergo the term “mods”) to increase nicotine uptake and to customize e-liquid constituents with flavors and variable ratios of the humectant vegetable glycerin (VG) to propylene glycol (Harvanko et al., 2019). Users found that increasing the amount of VG in these more powerful devices allowed for the production of large, opaque aerosol clouds and subsequent vape tricks reminiscent of smoke rings. Cloud chasing soon gained appeal among youth in particular, in contrast to middle-aged and older users more likely to use ENDS for smoking cessation (Katz et al.,

* Corresponding author at: University of Chicago, Department of Psychiatry & Behavioral Neuroscience, 5841 S. Maryland Avenue (MC-3077), Chicago, IL 60637, United States.

E-mail address: aking@bsd.uchicago.edu (A. King).

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Fig. 1. Examples of e-cigarette “cloud chasing” or vape tricks from the internet, social media, and vaping convention competitions.

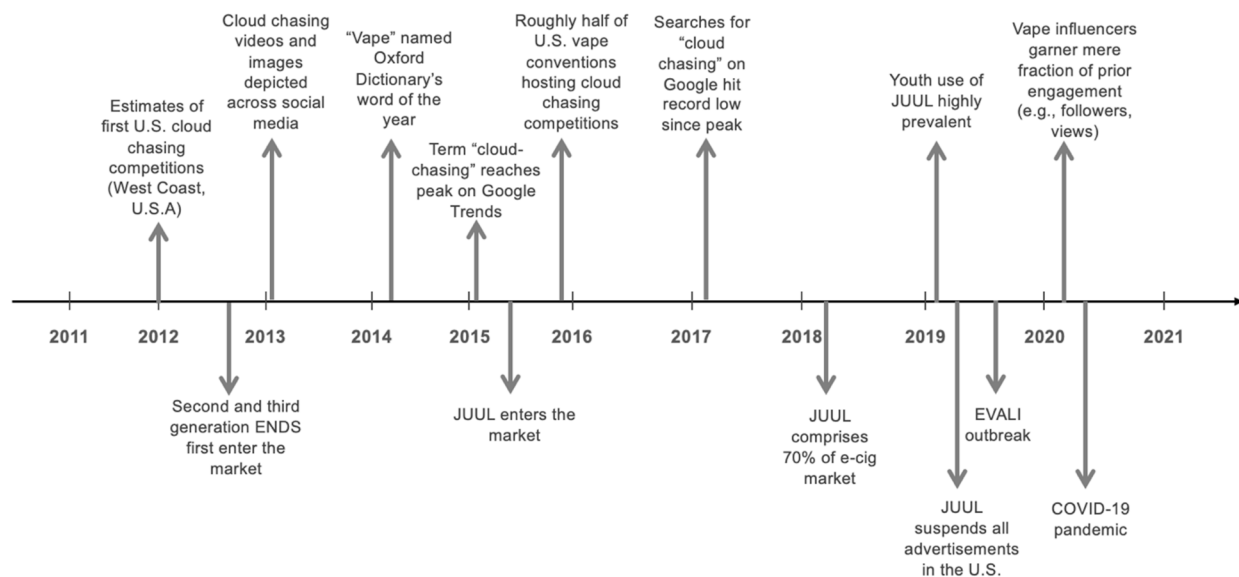


Fig. 2. Timeline of cloud chasing-relevant events: 2011–2021. *Note.* The estimate of timeframe for the first cloud chasing competitions come from [Raychaudhuri \(2016\)](#). Information on advent of second and third generation of ENDS supported by [Williams and Talbot \(2019\)](#). Data on cloud chasing on social media supported by [Trippers \(2014\)](#) and google data retrieved from google trends ([Google, n.d.](#)). Data on competitions at vape conventions is from [Williams \(2015\)](#). Data on searches for cloud chasing reaching record lows found using google trends data ([Google, n.d.](#)). Data on JUUL sales from [Herzog and Kanada \(2018\)](#) and youth use of JUUL from [Vallone et al. \(2019\)](#). The date for JUUL’s removal of U.S. advertisements retrieved from [Graham \(2019\)](#). Information on EVALI came from [Centers for Disease Control and Prevention \[CDC\] \(2020\)](#), [Leas et al. \(2021\)](#) and estimates of vape influencers’ decreased engagement on social media from [Trippers \(2014, 2017\)](#).

2019; [Tokle and Pedersen, 2019](#); [Kong et al., 2019](#); [Al-Hamdani et al., 2021](#)). The evolution of ENDS from simple “cigalikes” to more powerful, customizable mods propelled cloud chasing and vaping culture in the years following the commercial availability of these devices.

However, tank-based mods decreased in appeal by 2017 due to their complexity, coupled with the sharp rise in popularity of sleeker, closed-system nicotine-salt-based devices, particularly JUUL ([Keamy-Minor et al., 2019](#)). JUUL use became increasingly prevalent from 2017 to 2019, with approximately 10% of youth reporting ever use of the device ([Vallone et al., 2019](#)). This was due to its ease of use, inconspicuous design, high nicotine content in pods, and flavor options available at

that time ([Barrington-Trimis and Leventhal, 2018](#)). At its peak, JUUL sales accounted for over 70% of the e-cigarette market ([Herzog and Kanada, 2018](#)). The rapid change of the ENDS landscape resulted in fewer vapers using advanced mod devices. Thus, the movement towards smaller, less powerful “pod mod” devices and desire for more subtle vaping likely contributed to a decreased interest in cloud chasing ([Vassey et al., 2020](#); [Cwalina et al., 2021](#)).

Second, the explosion of tank-based devices occurred during a time of burgeoning social media use, and by 2013, cloud chasing became a distinct sub-culture and saw rapid spread through online sites including Instagram, Reddit and YouTube ([Tokle and Pedersen, 2019](#)). Indeed, the

spread of information fueled by social media and influencers led to the Oxford Dictionary naming “vape” the word of the year in 2014. Large vaping conventions that started in California in 2012 eventually made their way across the country and were often promoted on social media, generating new exposure as thousands of people gathered to see cloud chasing competitions. Sponsored influencers and vape companies took to YouTube to broadcast such competitions, create tutorials for building vapes, and provide coaching on cloud chasing techniques, attracting millions of views (Huang et al., 2016; Williams, 2015).

In 2016, cloud chasing started to experience a sudden decline in popularity as evidenced by steady decreases in searches for “cloud chasing” by Google trends data (Google, n.d.). Videos from leading influencers and YouTube sensations known for their vaping content were only collecting several thousand views by 2017 compared to sometimes millions of views from 2013 to 2016 (Trippers, 2014; Trippers, 2017). Where cloud competitions used to be commonplace at vaping conventions; there is now a dearth of promoted spaces where one can compete in tournaments or events.

Third, another factor in the initial popularity and then decline of the cloud chasing phenomenon was that regulatory action was not able to keep up with the rapid evolution of ENDS products. From 2011 to 2015, devices and e-liquids were sold to customers without regard to age limits as regulatory bodies had not been able to review device safety, health claims, and the rapid proliferation of brands, devices, and flavor options. This climate may have created widespread access to ENDS in youth and a culture that promoted vaping as a fun or even safe behavior. In 2016, the Food and Drug Administration (FDA) updated their jurisdiction over e-cigarettes and invoked marketing restrictions and product regulations for the first time. In 2019, the federal minimum age for tobacco sales, including e-cigarettes, was raised to 21 years of age and later flavors for pod devices were limited to tobacco or menthol. Such policy likely played a role in declines in youth vaping (Wang et al., 2021) and shifting attitudes away from more extreme and visible vaping behaviors, including cloud chasing, in lieu of more discrete products. As the FDA has recently authorized some vape products to stay on the market in 2021 while removing others, the intended and unintended consequences of regulatory measures will undoubtedly take years to unfold.

Finally, there were two health crises in 2019 and 2020 that likely perpetuated the decreased interest in cloud chasing. The first emerged in the spring of 2019 when the U.S. experienced an outbreak in lung injury among individuals using e-cigarettes to vape THC, termed “e-cigarette or vaping product use-associated lung injury” (EVALI). From April 2019–February 2020, there were more than 2,000 hospitalized cases and 60 deaths in the U.S. due to EVALI (Centers for Disease Control and Prevention [CDC], 2020). Though vitamin E acetate, found primarily in illegal THC-vaping products, was eventually identified as a major cause of EVALI (Blount et al., 2020), initial media coverage on dangers of vaping increased substantially at this time (Leas et al., 2021) and concerns about e-cigarette use diminished enthusiasm for vaping and increased harm perceptions (Tattan-Birch et al., 2020; Kreslake et al., 2021). Taken together, EVALI may have contributed to the decline in the promotion of vape tricks via in-person events as well as online.

The second major health crisis has been the SARS-CoV-2 virus (COVID-19) that emerged in winter of 2019 and grew to a global pandemic within months. While scientists continue to unravel the mechanisms of COVID-19, it is deemed a respiratory illness resulting in increased health concerns related to vaping behaviors in 2020 (Stanton et al., 2020; Majmundar et al., 2020; Klemperer and Villanti, 2021). The changes in vaping behaviors during the pandemic are multi-faceted and likely due to stay-at-home orders, business shut-downs, and lung health concerns (Kale et al., 2021). Mask-wearing and concerns about transmission of COVID-19 have also played a role in the cancellation of vaping conventions and cloud chasing competitions. Whether the increased hesitancy to use vape products or engage in cloud chasing behaviors will return to their initial popularity in adolescents and young adults remains uncertain in our post-pandemic world.

In sum, changes in ENDS technology, popularity, regulatory policies, and unprecedented health crises have influenced the appeal of cloud chasing from their initial rapid rise and subsequent fall this decade. While cloud chasing was initially portrayed in social media as somewhat innocuous entertainment, there are concerns about potential ENDS toxicity associated with these devices, (El-Hellani et al., 2020) and the possibility that the appeal of vape tricks enticed tobacco naïve youth to begin using ENDS via exposure on social media. There are also implications of passive exposure to aerosol clouds as some evidence shows that exposure to larger clouds increases desire to smoke cigarettes (Vena et al., 2019). It is possible that cloud chasing represented a fad that would have naturally waned regardless of regulatory measures and public health crises. Still, the abrupt decline suggests that these forces were likely a factor in the fall of vape tricks and it is unknown whether the phenomenon will see a resurgence post-pandemic. There are pertinent lessons learned given these behaviors promoted ENDS as sources of entertainment and popular appeal versus a method of tobacco harm reduction. Regulations on constituents and device types necessary for creation of vape tricks may be indicated as researchers and policy makers navigate the evolution of ENDS. Further, the promotion of health-focused messages on social media platforms may help to increase accurate information and harm perceptions (Villanti et al., 2021; Erku et al., 2021). Restrictions on events like vape conventions that gamify vaping and monitoring of online videos that promote use of products for entertainment may help prevent future youth-appealing vape tricks from proliferating. While visual aspects of tobacco product use may always appeal to youth, effective health communication and regulation can help counteract or attenuate factors that increase uptake in such at-risk populations.

CRedit authorship contribution statement

Emma Brett: Conceptualization, Writing – original draft. **Robert Krissinger:** Investigation, Writing – review & editing. **Andrea King:** Conceptualization, Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

- Al-Hamdani, M., Hopkins, D.B., Hardardottir, A., Davidson, M., 2021. Perceptions and experiences of vaping among youth and young adult E-cigarette users: considering age, gender, and tobacco use. *J. Adolesc. Health* 68 (4), 787–793.
- Barrington-Trimis, J.L., Leventhal, A.M., 2018. Adolescents’ use of “pod mod” e-cigarettes—urgent concerns. *NEJM* 379 (12), 1099–1102.
- Blount, B.C., Karwowski, M.P., Shields, P.G., Morel-Espinosa, M., Valentin-Blasini, L., Gardner, M., Braselton, M., Brosius, C.R., Caron, K.T., Chambers, D., Corstvet, J., Cowan, E., De Jesús, V.R., Espinosa, P., Fernandez, C., Holder, C., Kuklenyik, Z., Kusovschi, J.D., Newman, C., Reis, G.B., Rees, J., Reese, C., Silva, L., Seyler, T., Song, M.-A., Sosnoff, C., Spitzer, C.R., Tevis, D., Wang, L., Watson, C., Wewers, M.D., Xia, B., Heitkemper, D.T., Ghinai, I., Layden, J., Briss, P., King, B.A., Delaney, L.J., Jones, C.M., Baldwin, G.T., Patel, A., Meaney-Delman, D., Rose, D., Krishnasamy, V., Barr, J.R., Thomas, J., Pirkle, J.L., 2020. Vitamin E acetate in bronchoalveolar-lavage fluid associated with EVALI. *NEJM* 382 (8), 697–705.
- Centers for Disease Control and Prevention [CDC]. Outbreak of lung injury associated with e-cigarette use, or vaping. *Smoking & Tobacco Use*. February 5th, 2020. Accessed June 12th, 2021. https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html.
- Cwalina SN, Braymiller JL, Leventhal AM, et al. Prevalence of young adult vaping, substance vaped, and purchase location across five categories of vaping devices. *Nicotine Tob Res* 2021;23(5):829-35.

- Dai, H., Leventhal, A.M., 2019. Prevalence of e-cigarette use among adults in the United States, 2014–2018. *JAMA* 322 (18), 1824–1827.
- El-Hellani, A., El-Hage, R., Salman, R., Tali, S., Zeaiter, J., Eissenberg, T., Shihadeh, A., Saliba, N.A., 2020. Electronic cigarettes are chemical reactors: implication to toxicity. *Chem. Res. Toxicol.* 33 (10), 2489–2490.
- Erku DA, Bauld L, Dawkins L, et al. Does the content and source credibility of health and risk messages related to nicotine vaping products have an impact on harm perception and behavioural intentions? A systematic review. *Addict* 2021.
- Google. (n.d.). Google Trends data. Retrieved from <https://trends.google.com/trends/explore?date=2010-09-21%202021-10-21&geo=US&q=%2Fm%2F0136zmsj>.
- M. Graham September 25). JUUL suspends broadcast, print and digital product advertising in the US CNBC. 2019 <https://www.cnbc.com/2019/09/25/juul-suspends-broadcast-print-and-digital-product-ads-in-the-us.html>.
- Harvanko, A., Kryscio, R., Martin, C., Kelly, T., 2019. Stimulus effects of propylene glycol and vegetable glycerin in electronic cigarette liquids. *Drug Alcohol Depend.* 194, 326–329.
- Herzog, B., Kanada, P.N., 2018. tobacco “all channel” data april 21, 2018.
- Huang, J., Kornfield, R., Emery, S.L., 2016. 100 million views of electronic cigarette YouTube videos and counting: quantification, content evaluation, and engagement levels of videos. *JMIR* 18 (3), e67. <https://doi.org/10.2196/jmir.4265>.
- Kale, D., Herbec, A., Perski, O., Jackson, S.E., Brown, J., Shahab, L., 2021. Associations between vaping and Covid-19: Cross-sectional findings from the HEBECO study. *Drug Alcohol Depend.* 221, 108590. <https://doi.org/10.1016/j.drugalcdep.2021.108590>.
- Katz, S.J., Erkinen, M., Lindgren, B., Hatsukami, D., 2019. Beliefs about E-cigarettes: a focus group study with college students. *Am. J. Health Behav.* 43 (1), 76–87.
- Keamy-Minor, E., McQuoid, J., Ling, P.M., 2019. Young adult perceptions of JUUL and other pod electronic cigarette devices in California: a qualitative study. *BMJ Open* 4 (4), e026306. <https://doi.org/10.1136/bmjopen-2018-026306>.
- Klemperer, E., Villanti, A., 2021. Motivations and methods of dual users to quit vaping: survey findings from adults who use electronic and combustible cigarettes. *Tob. Induc. Dis.* 19, 1–9.
- Kong, G., LaVallee, H., Rams, A., Ramamurthi, D., Krishnan-Sarin, S., 2019. Promotion of vape tricks on YouTube: content analysis. *JMIR* 21 (6), e12709. <https://doi.org/10.2196/12709>.
- J.M. Kreslake M.C. Diaz M. Shinaba D.M. Vallone E.C. Hair Youth and young adult risk perceptions and behaviours in response to an outbreak of e-cigarette/vaping-associated lung injury (EVALI) in the USA tobaccocontrol-2020-056090 10.1136/tobaccocontrol-2020-056090.
- Leas, E.C., Nobles, A.L., Caputi, T.L., Dredze, M., Zhu, S.-H., Cohen, J.E., Ayers, J.W., 2021. News coverage of the E-cigarette, or Vaping, product use Associated Lung Injury (EVALI) outbreak and internet searches for vaping cessation. *Tob. Control* 30 (5), 578–582.
- Leavens, E.L.S., Stevens, E.M., Brett, E.I., Hébert, E.T., Villanti, A.C., Pearson, J.L., Wagener, T.L., 2019. JUUL electronic cigarette use patterns, other tobacco product use, and reasons for use among ever users: results from a convenience sample. *Addict. Behav.* 95, 178–183.
- Majmundar A, Allem JP, Cruz TB, et al. Public health concerns and unsubstantiated claims at the intersection of vaping and COVID-19. *Nicotine Tob Res* 2020;22(9): 1667-8.
- Pepper, J.K., Lee, Y.O., Watson, K.A., Kim, A.E., Nonnemaker, J.M., Farrelly, M.C., 2017. Risk factors for youth e-cigarette “vape trick” behavior. *J. Adolesc. Health* 61 (5), 599–605.
- Raychaudhuri, D. (2016, October 28). Cloud chasing competitive vapers make smoke into sculptures. *LA Weekly*. <https://www.laweekly.com/cloud-chasing-competitive-vapers-make-smoke-into-sculptures/>.
- Stanton, R., To, Q.G., Khalesi, S., Williams, S.L., Alley, S.J., Thwaite, T.L., Fenning, A.S., Vandelanotte, C., 2020. Depression, anxiety and stress during COVID-19: associations with changes in physical activity, sleep, tobacco and alcohol use in Australian adults. *Int. J. Environ. Res. Public Health* 17 (11), 4065. <https://doi.org/10.3390/ijerph17114065>.
- Tattan-Birch, H., Brown, J., Shahab, L., Jackson, S.E., 2020. Association of the US outbreak of vaping-associated lung injury with perceived harm of e-cigarettes compared with cigarettes. *JAMA Netw Open* 3 (6), e206981. <https://doi.org/10.1001/jamanetworkopen.2020.6981>.
- Tokle, R., Pedersen, W., 2019. “Cloud chasers” and “substitutes”: e-cigarettes, vaping subcultures and vaper identities. *Sociol. Health Illn.* 41 (5), 917–932.
- Rip Trippers. Cloud Chasing 101 Part 1 [Video]. YouTube. <https://www.youtube.com/watch?v=NfqSh03FEys>. Published June 23, 2014. Accessed June 10, 2021.
- RiP Trippers. Vaping For Beginners! The Joyetech Exceed D19 Vape Starter Kit! [Video]. YouTube. https://www.youtube.com/watch?v=Q_tGGNqQivA. Published November 6, 2017. Accessed June 10, 2021.
- Tsai, J., Walton, K., Coleman, B.N., Sharapova, S.R., Johnson, S.E., Kennedy, S.M., Caraballo, R.S., 2018. Reasons for electronic cigarette use among middle and high school students—National Youth Tobacco Survey, United States, 2016. *Morb. Mortal. Wkly Rep.* 67 (6), 196–200.
- Vallone, D.M., Bennett, M., Xiao, H., Pitzer, L., Hair, E.C., 2019. Prevalence and correlates of JUUL use among a national sample of youth and young adults. *Tob. Control* 28 (6), 603–609.
- Vassey, J., Metayer, C., Kennedy, C.J., Whitehead, T.P., 2020. # Vape: measuring e-cigarette influence on Instagram with deep learning and text analysis. *Front Commun* 4, 75.
- Vena, A., Howe, M., Cao, D., King, A., 2019. The role of E-liquid vegetable glycerin and exhaled aerosol on cue reactivity to tank-based electronic nicotine delivery systems (ends). *Psychopharmacol* 236 (7), 2083–2092.
- Villanti, A.C., LePine, S.E., West, J.C., Cruz, T.B., Stevens, E.M., Tetreault, H.J., Unger, J.B., Wackowski, O.A., Mays, D., 2021. Identifying message content to reduce vaping: Results from online message testing trials in young adult tobacco users. *Addict. Behav.* 115, 106778. <https://doi.org/10.1016/j.addbeh.2020.106778>.
- T.W. Wang A.S. Gentzke L.J. Neff E.V. Glidden A. Jamal E. Park-Lee C. Ren K.A. Cullen B. A. King K.A. Hacker 4 6 2021 e2111336 10.1001/jamanetworkopen.2021.11336.
- Wang, T.W., Neff, L.J., Park-Lee, E., Ren, C., Cullen, K.A., King, B.A., 2020. E-cigarette use among middle and high school students—United States, 2020. *Morb. Mortal. Wkly Rep.* 69 (37), 1310–1312.
- Williams, R.S., 2015. VapeCons: E-cigarette user conventions. *J. Public Health Policy* 36 (4), 440–451.
- Williams, M., Talbot, P., 2019. Design features in multiple generations of electronic cigarette atomizers. *Int. J. Environ. Res. Public Health* 16 (16), 2904.